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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
B65H 35/08, B26D 1/62, 3/12

A1

(11) International Publicati n Number: **WO 97/23398**

(43) International Publication Date: 3 July 1997 (03.07.97)

(21) International Application Number: PCT/DK96/00532

(22) International Filing Date: 16 December 1996 (16.12.96)

(30) Priority Data:

1470/95	22 December 1995 (22.12.95)	DK
0067/96	22 January 1996 (22.01.96)	DK

(71) Applicant *(for all designated States except US)*: WJC SYSTEC A/S [DK/DK]; Avedøreholmen 84, DK-2650 Hvidovre (DK).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: FELDTHAUS, Christian [DK/DK]; I.H. Mundtsvej 34 B, DK-2830 Virum (DK).

(74) Agent: PLOUGMANN, VINGTOFT & PARTNERS A/S; Sankt Annæ Plads 11, P.O. Box 3007, DK-1021 Copenhagen K (DK).

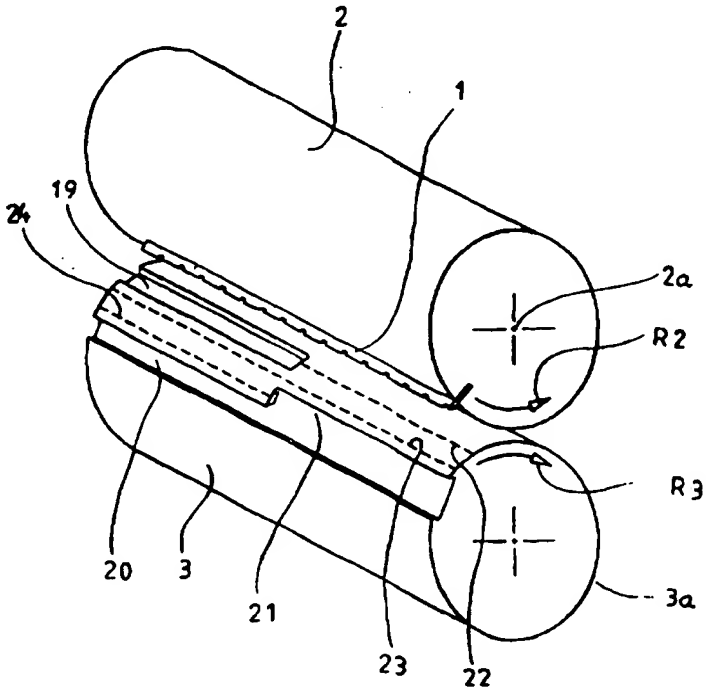
(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD AND DEVICE FOR PERFORATING AND/OR CUTTING AND/OR SCORING A WEB.

(57) Abstract

A perforation blade member (1) is arranged in and protrudes beyond the surface of a roller (2). In the surface of the roller (3) there are provided two recesses or indentations (19 and 20), the recess (19) extending along half the length of the roller (3) and the recess (20) extending along the entire length of the roller (3), the recess (20) having a wider portion (21) extending along the other half of the length of the roller (3). In operation the rollers (2 and 3) rotate with a peripheral speed substantially equal to the speed of a web being moved lengthwise between the rollers and the blade member (1) may carry out four perforation operations in accordance with the position of the roller (3) and thereby the recesses (19, 20 and 21) relative to the blade member (1) in the active position of said blade member in contact with the web. In case the roller (3) is in a position to be contacted by the blade member (1) along dotted line (22), a first perforation will be carried out in the web as the blade member (1) will only perforate the web along the line (22) and not along the recess (19) where the web only will be deflected by the blade member (1). Correspondingly, a second perforation will be performed in case the blade member (1) contacts the roller (3) along the dotted line (23), and a third perforation will be performed in case the blade member (1) contacts the roller (3) along the dotted line (24) and finally, no perforation will be performed in case the blade member (1) is opposite the recess (20).



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Method and device for perforating and/or cutting and/or scoring a web.

This invention relates to a method and a device for sequentially perforating and/or cutting and/or scoring a continuous web of material such as paper, cardboard or the like being moved lengthwise between active means for sequentially perforating and/or cutting and/or scoring the web and counter pressure means for pressing the web against the active means when the active means and the counter pressure means are in an active position relative to one another.

When dealing with continuous webs of material such as paper, cardboard or the like on which different operations such as printing, perforating, cutting, scoring or folding are to be performed sequentially on predetermined lengths of the web, for instance when printing forms or bills, it is desirable to have as large a degree of flexibility as possible so as to be able to deal with as many different requirements with the same equipment and particularly in the same working process thus avoiding downtime for retooling or to change equipment.

When printing for instance bills consisting of a variable number of sheets containing the bill specification, it is often desirable to provide a tear off strip at the bottom of the final page of the bill for payment purposes, for instance at the Post Office. This tear off strip is provided by applying a transverse perforation line across that sheet at a certain distance from the bottom of the sheet.

In the known devices of the type in reference it is necessary to choose between several disadvantageous options comprising either providing all the sheets of a bill with perforation lines or separately producing the first sheets of a bill in one operation where no perforation is performed and separately producing the last sheet of the bill in another operation where the tear off perforation is provided on this last sheet. Thereafter the different sheets of a particular bill have to be consolidated for mailing to the customer thus entailing additional work and possibilities of errors.

The reasons for this are explained in the following in connection with Figs. 1-3 which illustrate the method employed in known prior art devices.

It is a main object of the invention to provide a method whereby a large degree of flexibility is obtained when dealing with continuous webs of the type indicated, and more particularly, to allow selectively applying a perforation, a cut or a score selectively along the length of a continuous web of paper so that for instance a tear off portion may be provided in one selected sheet, preferably the last one, of a multiple sheet bill being printed in a series with other bills comprising different numbers of sheets.

This object is obtained according to the invention in that the counter pressure means and/or that the active means are selectively moved into and out of a selectively active position in which they exert pressure against each other and against the portion of the web lying therebetween during the movement of the web.

To obtain a particularly clean perforation which is of importance in applications where the web is folded afterwards the active means are preferably moved substantially in the same direction and at a speed comparable to the speed of the web when the active means and the counter pressure means are in the selectively active position.

To further obtain a clean perforation the counter pressure means are preferably moved substantially in the same direction and at a speed comparable to the speed of the web when the active means and the counter pressure means are in the selectively active position.

Advantageously the active means and the counter pressure means may be substantially linear and extend substantially at right angles to the direction of movement of the web, and

furthermore the movement of the active means may comprise pivoting about an axis substantially at right angles to the direction of movement of the web and the movement of the counter pressure means may comprise pivoting about an axis substantially at right angles to the direction of movement of the web.

Preferably, the active means are arranged on the outer surface of a first rotative body being rotated with a peripheral speed generally comparable with and preferably substantially equal to the speed of movement of the web, and furthermore, the counter pressure means are preferably arranged on a surface portion arranged on a second rotative body being rotated with a peripheral speed generally comparable with and preferably substantially equal to the speed of movement of the web.

A further object of the invention is to allow sequentially perforating, cutting or scoring by simple means with selectable different configurations as well as selectable location and therefore the counter pressure means may advantageously comprise one or more inactive regions with an increased distance from the active means in the selectively active position of same, the method comprising the step of selectively retarding or advancing the movement of the counter pressure means and/or the active means by an amount sufficient to locate an inactive region opposite the active means in the selectively active position of same, the inactive region having a width and depth sufficient to allow the web to be deflected into the inactive region by the active means.

Preferably, the active means comprise at least one linear perforating, cutting or scoring means extending across the entire width of a longitudinal web portion and the counter pressure means comprise at least one inactive region extending across the entire width of a longitudinal web portion, at least one inactive region extending across one part of the

width of the web portion and at least one inactive region extending across another part of the width of the web portion, the method further comprising the step of selectively retarding or advancing the movement of the counter pressure means and/or the active means by an amount sufficient to locate a selected inactive region opposite the perforating, cutting or scoring means or a selected one of same in the selectively active position of same.

Advantageously, the inactive region or regions may be constituted by one or more substantially linear and substantially mutually parallel recesses or indentations in the surface portion. Hereby, a particularly simple and inexpensive method is obtained.

Preferably, in the usual case where the speed of travel or movement of the web varies because of some factor such as the requirements of associated processes on the web, the speed of movement of the active means and/or the counter pressure means is controlled according to a variable speed of movement of the web.

A particularly simple and reliable method is obtained by the retardation and the advancement of the movement of the counter pressure means and/or the active means being controlled by signals such as from an associated printing device, some other controlling apparatus or controlling electronics, or from sensing means, said sensing means sensing the passage thereby of a particular mark such as a bar code on the web corresponding to a desired respective perforating, cutting or scoring operation on the web.

Preferably, the second rotative body has a skew inclination relative to the first rotative body and at least the region of the outer surface of the second rotative body encompassing the counter pressure means has a corresponding hyperboloidical shape for allowing the active means to contact the counter pressure means progressively along the length thereof

during rotation of the first and second rotative body through the selectively active position thereof. Hereby, the impact forces and the noise level produced by the contact between the active means and the counter pressure means is significantly reduced.

The invention also relates to a device for sequentially perforating and/or cutting and/or scoring a web of material such as paper, cardboard or the like arranged to move lengthwise through the apparatus, said device comprising active means for sequentially perforating and/or cutting and/or scoring the web and counter pressure means for pressing the web against the active means when the web is moved therebetween in an active position of the active means relative to the counter pressure means, and said device according to the invention is characterized in that the device further comprises first and/or second displacement means for selectively displacing the active means and the counter pressure means, respectively, relative to one another into and out of a selectively active position in which they exert pressure against each other and against the portion of the web lying therebetween during the movement of the web.

Preferably, the active means are arranged on a first surface portion arranged on a first rotative body arranged for rotation about a first axis, and the counter pressure means are arranged on a second surface portion arranged on a second rotative body arranged for rotation about a second axis, the arrangement and the spacing of the first and second axis relative to each other and relative to the web being such that the active means may selectively be brought into an active position relative to the counter pressure means and the web while moving in substantially the same direction and at substantially the same speed as the web, the counter pressure means comprising one or more inactive regions and active regions arranged at a smaller and a larger distance, respectively, from the second axis, the inactive region or

regions having a width and depth sufficient to allow the web to be deflected into the inactive region by the active means.

Advantageously, the first and/or second displacement means may comprise means to selectively retard or advance the rotation of the second rotative body relative to the rotation of the first rotative body by an amount sufficient to selectively locate an inactive or an active region opposite at least part of the active means in the active position of same.

A particularly simple device is obtained when the active means comprise a substantially rectilinear, perforating, cutting or scoring blade member arranged protruding from the surface of a first rotative body and extending substantially parallel to the axis of rotation of the first rotative body, and furthermore, when the counter pressure means comprise one or more substantially rectilinear recesses or indentations in the second surface portion arranged on the second rotative body, the recess or recesses extending substantially parallel to the axis of rotation of the second rotative body, the recesses constituting the inactive region or regions and at least part of the unrecessed or unindented portions of said second surface portion adjacent the recesses constituting the active region or regions.

In a preferred embodiment the first and/or the second rotative body is constituted by a substantially circular cylindrical roller.

A device allowing dealing with for instance two or more parallel rows of printed sheets is obtained in that, in the said active position, at least one blade member extends across the entire width of a longitudinal portion of the web, at least one recess extends across one part of the width of the web portion and at least one recess extends across another part of the web portion.

Preferably, the parts of the width of the longitudinal web portion across which the various recesses extend in said active position comprise the entire width of the web portion, one half of the width extending from a longitudinal edge of the web portion and the other half of the width extending from the other longitudinal edge of the web portion.

In a preferred embodiment, the counter pressure means comprise one or more substantially rectilinear raised portions or ridges in the second surface portion arranged on the second rotative body, the ridge or ridges extending substantially parallel to the axis of rotation of the second rotative body, the ridge or ridges constituting the active region or regions and at least part of the portions of said second surface portion adjacent the ridge or ridges constituting the inactive region or regions.

Advantageously, said second surface portion may be integral with the second rotative body.

In certain applications it is advantageous that said second surface portion is part of a replaceable element attached to the second rotative body.

Preferably, at least the second surface portion and the underlying region thereof is made from a material highly resistant to wear caused by repeated contact with the blade member.

In a preferred embodiment the first and the second axes are skewed in relation to each other, the active means comprise a substantially linear, perforating, cutting or scoring blade member arranged protruding from the first surface portion, and the counter pressure means comprise one or more substantially linear recesses or indentations in the second surface portion, the recesses constituting the inactive region or regions, and at least part of the unrecessed or unindented portions of said second surface portion adjacent the recesses

constituting the active region or regions; at least the region of the second surface region encompassing the counter pressure means having a hyperboloidical shape corresponding to the skewed relationship of the first and the second axis such that the blade member contacts the counter pressure means progressively along the length thereof during rotation of the first and second rotative body through the selectively active position thereof, the blade member and/or the recess or recesses extending substantially rectilinearly and substantially perpendicularly to the direction of movement of the web with a skewed relationship to one another; and/or the blade member and/or the recesses having a curvature corresponding to said hyperboloidical shape and/or said skewed relationship between the first and the second axis and/or between the blade member and the recess or recesses.

In a preferred embodiment, the said second displacement means comprise a displacement gear displaceable in its own plane in a direction substantially perpendicular to its axis of rotation and substantially perpendicular to the direction of the diameter of the displacement gear connecting the meshing regions of the displacement gear with two adjacent gears, the displacement gear forming part of a driving gear train connecting a driven gear and a rotation gear for rotating the second rotative body.

Preferably, the driven gear is connected to a rotation gear for rotating the first rotative body by means of a transmission mechanism such as a gear train, a drive chain or a toothed belt.

Advantageously, the displacement gear may be displaced by means of a piston and cylinder device, the piston having a number of different positions corresponding to the different positions of the counter pressure means relative to the active means in the active position of same.

In a preferred embodiment the device further comprises first controlling means for controlling the various operations of the device in dependency of a variable speed of movement of the web therethrough, first sensing means for sensing the variable speed, such as sensing means to sense the tension of a depending loop of the web prior to or after passage through the device, the first controlling means adjusting the speed and frequency of the various operations according to signals transmitted thereto, and first transmission means for transmitting signals from the first sensing means to the first controlling means and furthermore, the device further comprises second sensing means for sensing marks such as bar codes on the web, second transmission means for transmitting signals from the second sensing means to second controlling means for controlling the operation of the first and/or second displacement means in accordance with a selected perforating, cutting or scoring operation indicated by the respective mark on the web being sensed.

Alternatively, the device may advantageously further comprise signal receiving means for receiving a signal such as from an associated printer, second controlling means for controlling the operation of the first and/or second displacement means in accordance with a selected perforating, cutting or scoring operation indicated by the respective signal being received.

So as to achieve a great degree of flexibility as regards the distance between the perforation, score or cut along the web the first roller may be arranged interchangeable with one or more rollers having a different diameter and/or a different number of active means, and the second roller may be provided with a series of identical sets of counter pressure means arranged equidistantly around the circumference of the second roller.

In such case, the device may further comprises means to advance or retard the second roller such that different sets of counter pressure means are sequentially brought into the

active position relative to an active means of the first roller.

This invention further relates to active means having the features defined in the following detailed description of various embodiments of the invention or in any of the appended claims 15-35, to counter pressure means having the features defined in the following detailed description of various embodiments of the invention or in any of the appended claims 15-35, or a rotative body having the features defined in the following detailed description of various embodiments of the invention or in any of the appended claims 16-35.

Various embodiments of the method and the device according to the invention will now be described and illustrated by way of example with reference to the accompanying drawing, in which:

Figs. 1-3 schematically illustrate end views of three prior art devices,

Figs. 4 and 5 schematically illustrate a first embodiment of a device according to the invention in an active position and an inactive position, respectively,

Fig. 6 schematically illustrates a second embodiment of a device according to the invention in an active position,

Fig. 7 schematically illustrates a third embodiment of a device according to the invention in an inactive position,

Fig. 8 schematically illustrates a fourth embodiment of a device according to the invention in conjunction with a web of paper,

Fig. 9 is a more detailed and enlarged view of the embodiment of Fig. 8 with the web removed,

Fig. 10 schematically illustrates a fifth embodiment of a device according to the invention in conjunction with a web of paper,

Fig. 11 is a more detailed and enlarged view of the embodiment of Fig. 10,

Fig. 12 schematically illustrates a sixth embodiment of a device according to the invention in conjunction with a web of paper,

Fig. 13 is a more detailed and enlarged view of the embodiment of Fig. 12,

Fig. 14 is a cut away and enlarged detail of one end of the counter pressure means of the embodiment of Fig. 12,

Fig. 15 is a diagrammatical elevational end view of a seventh and currently most preferred embodiment of the device according to the invention,

Figs. 16-18 are further schematic illustrations of embodiments of the device according to the invention, and

Figs. 19-21 are schematic illustrations of an embodiment of active and inactive means according to the invention for carrying out perforation operations in the direction of movement of the web.

In the following, similar elements and features are indicated by like designations.

Referring now to Figs. 1-3 in which known prior art devices are illustrated schematically, a rectilinear perforating, cutting or scoring blade member 1 is mounted on the surface of a cylindrical roller 2, the active edge of the blade member 1 protruding a certain uniform distance from said

surface. The roller 2 rotates counter clockwise around an axis 2a. A counter pressure roller 3 is arranged on an axis of rotation 3a for clock wise rotation, the roller 3 having its surface spaced sufficiently from the surface of the roller 2 to allow passage of a continuous web 4 of paper being moved towards the left in the drawing and passage of the blade member 1 past the surface of the roller 3. The rollers 2 and 3 rotate with a peripheral speed substantially equal to the speed of movement of the web 4.

When the blade member 1 reaches its lowest position pointing vertically downwards it will ideally be in a suitably firm contact with the surface of the cylinder 3 in the case of the devices of Figs. 1-2 and with a surface of a rod 5 of abrasive resistant material embedded in and protruding from the surface of the roller 3.

The web 4 will be pinched between the blade member 1 and the surface of the roller 3 or the surface of the rod 5, respectively, thereby either being perforated, cut or scored depending on the function and configuration of the blade member 1. In the following only perforation will be discussed for the sake of simplicity and clarity, but the same features will normally apply to cutting and scoring.

For a given diameter of the rollers 2 and 3, a given fixed distance between the perforation, cut or score lines will result. If it is necessary to vary this distance it is necessary to vary the diameter of at least the roller 2 as indicated in Fig. 2 where the roller 2 has a larger diameter than the roller 3 resulting in a larger distance between the perforation line than if the roller 2 had the same diameter as roller 3. In the embodiment of Fig. 3, the diameter of both the rollers 2 and 3 would have to be varied simultaneously and to the same degree.

In case the variation in the distance between perforation line were to be a multiple of a normal letter sheet length

for bills and the like the resulting changes in diameter of the rollers 2 and 3 will be large and will severely limit the number of full sheet lengths between the perforation lines.

In any case, it is not possible to vary the distance between the perforation lines selectively during operation of these known devices.

Referring now to Figs. 4 and 5 illustrating schematically a first a basic embodiment of a device according to the invention, the configuration is very similar to the known device of Fig. 3.

The essential difference is that the device according to Figs.4-5 comprises not shown displacement means for selectively slightly retarding and advancing the rotation of the roller 3 with respect to the roller 2 during a full rotation of the rollers so that the blade member 1 will pinch the web 4 against the surface of the rod 5 as shown in Fig. 1 whenever a perforation is to be performed and will deflect the web 4 alongside the rod 5 with a pressure small enough to avoid perforating or even appreciably marking the web 4 whenever a perforation is to be skipped.

If the web 4 for instance is of paper to be printed up into bills consisting of a variable number of sheets containing the bill specification, it is often desirable to provide a tear off strip at the bottom of the final page of the bill for payment purposes, for instance at the Post Office. This tear off strip is provided by applying a transverse perforation line across the sheet at a certain distance from the bottom of the sheet.

In the known devices it is necessary to choose between several disadvantageous options comprising either providing all the sheets of a bill with perforation lines or separately producing the first sheets of a bill in one operation where no perforation is performed and separately producing the last

sheet of the bill in another operation where the tear off perforation is provided on this last sheet. Thereafter the different sheets of a particular bill have to be consolidated for mailing to the customer thus entailing additional work and possibilities of errors.

In the device shown in Figs. 4-5 all the sheets of a particular multiple sheet bill may be printed in sequence in a printing device associated with the device according to the invention and the roller 3 may be in the inactive position shown in Fig. 5 for each revolution of the rollers 2 and 3 until marks on the web 4, such as bar codes, sensed by a not shown sensing means generate a perforation signal to not shown controlling means that cause the displacement means to advance the rotation of the roller 3 during a revolution of same until it is in the active position shown in Fig. 4 whereby a perforation line is provided on the last sheet of the bill.

If the next bill is a single sheet bill, the rod 5 will still be in the active position shown in Fig. 4 at the end of the next revolution of the rollers 2 and 3 thereby providing a perforation line on this sheet. Otherwise the displacement means will, during the next revolution of the rollers, retard the rotation of the roller 3 to cause the rod 5 to revert to the inactive position shown in Fig. 5. The various sheets of the different bills may thereafter be cut off from the web 4 in associated devices and according to the folding, enveloping and mailing requirements.

Thus, selective perforation is achieved with simple means and entailing small relative movements of the rollers 2 and 3 during their often very high speed rotation entailed by the processing of many thousands of sheets per hour which is important because of the consequent short time period for retarding or advancing the rotation of the roller 3.

Referring now to Fig. 6 two blade members 6 and 7 are replaceably arranged on a surface of a rotative body 8 arranged for rotation about an axis 8a and two rods 9 and 10 are replaceably embedded in the surface of a rotative body 11 arranged for rotation about an axis 11a. In the position shown in Fig. 6 the blade member 7 is pressing a web 4 against the rod 9 and thereby perforating, cutting or scoring it.

Referring now to Fig. 7, three blade members 12, 13 and 14 are replaceably arranged on a surface of a rotative body 2 arranged for rotation about an axis 2a and three rods 15, 16 and 17 are replaceably embedded in the surface of a rotative body 18 arranged for rotation about an axis 18a. In the position shown in Fig. 7 the blade member 14 is in an inactive position where the blade member 14 is deflecting the web 4 alongside the rod 15.

The embodiments of the device according to the invention shown in Figs. 6 and 7 illustrate some of the possible variations of number and the arrangement of the active means and the counter pressure means on rotative bodies for carrying out embodiments of the method according to the invention. The reduced cross sectional areas of the rotative bodies 8, 11 and 18 as compared to cylindrical rollers reduces the inertia of said bodies thereby reducing the necessary force and accompanying noise inherent in displacing the active means and the counter pressure means relative to each other in the short period of time available in connection with high speed processing of the web 4. Many other possible configurations of the rotative bodies are conceivable as long as a suitable circular path of the active means and the counter pressure means is achieved thereby. The blade members 6, 7, 12, 13 and 14 may be perforating, cutting or scoring blade members, respectively, according to the desired configuration of the processed web. The circumference defined by the rotative body 18 may for instance be half the circumference defined by the

rotative body 2, the corresponding blade members 12, 13 and 14 contacting different ones of the rods 15, 16 and 17 for each revolution and thereby allowing smaller longitudinal distances between perforations while still giving enough space on the rotative body 2 to mount the blade members 12, 13 and 14. This may also be achieved by having two diametrically opposite blade members 1 on the roller 2 in Fig. 5 and a single rod 5 on the roller 3, the circumference defined by the blade members being double the circumference defined by the rod.

Referring now to Figs. 8 and 9 schematically illustrating a fourth embodiment of the device according to the invention, a continuous web 4 is moved parallel to the arrow R1 between two cylindrical rollers 2 and 3 arranged for rotation in the direction of the arrows R2 and R3, respectively, about axes 2a and 3a, respectively.

A substantially rectilinear perforation blade member 1 is replaceably arranged in and protrudes beyond the surface of the roller 2. In the surface of the roller 3 there are provided two recesses or indentations 19 and 20, the recess 19 extending along half the length of the roller 3 and the recess 20 extending along the entire length of the roller 3, the recess 20 having a wider portion 21 extending along the other half of the length of the roller 3.

In operation the rollers 2 and 3 rotate with a peripheral speed substantially equal to the speed of the web 4 and the blade member 1 may carry out four different operations in accordance with the position of the roller 3 and thereby the recesses 19, 20 and 21 relative to the blade member 1 in the active position of said blade member in contact with the web.

In the case the roller 3 is in a position to be contacted by the blade member 1 along dotted line 22, a perforation 25 will be carried out in the web 4 as the blade member 1 will only perforate the web 4 along the line 22 and not along the

recess 19 where the web 4 only will be deflected by the blade member 1. Correspondingly, the perforations 26 will be performed in case the blade member 1 contacts the roller 3 along the dotted line 23, and the perforations 27 will be performed in case the blade member 1 contacts the roller 3 along the dotted line 24 and finally, no perforation will be performed in case the blade member 1 is opposite the recess 20.

The relative dimensions of the perforations and the teeth on the blade member 1 are not shown in their actual size for sake of clarity and the distances between the perforations 25-27 are also for the sake of clarity not shown with their correct size corresponding to the circumference of the roller 2. Finally, the relative dimensions of the recesses 19-21 are shown enlarged for the sake of clarity.

By means of this embodiment it is for instance possible to print and selectively perforate two rows of sheets for bills on one web 4 or on two parallel webs arranged alongside each other instead of the one web 1 shown. Hereby, the capacity of the device is increased to nearly double while maintaining the advantage of being able to provide a tear out portion on selected sheets of the bills.

The web 4 shown in Fig. 8 has a width corresponding to double the width of for instance a bill sheet, the web being advanced or moved between the rollers 2 and 3 by for instance friction rollers (not shown) arranged after the device. However, the web 4 may be provided with a row of apertures along each longitudinal edge region for engaging peripheral teeth of traction wheels for moving the web. In this case the blade member 1 and the recesses 19, 20 and 21 only will extend across the longitudinal portion or strip of the web located between such edge regions, the edge regions and the longitudinal web portion conveniently being separated by longitudinally extending lines of perforations for being able to remove the edge regions from the web portion before for

instance mailing the sheets of the bills. Said edge regions may also conveniently be cut off in a subsequent step.

Referring now to Figs. 10 and 11 schematically illustrating a fifth embodiment of the device according to the invention, a continuous web 4 is moved parallel to the arrow R1 between two cylindrical rollers 2 and 3 arranged for rotation in the direction of the arrows R2 and R3, respectively, about axes 2a and 3a, respectively.

A substantially rectilinear perforation blade member 1 is replaceably arranged in and protrudes beyond the surface of the roller 2. In the surface of the roller 3 there are provided two recesses or indentations 19 and 20, the recess 19 extending along one third of the length of the roller 3 and the recess 20 extending along the entire length of the roller 3, the recess 20 having a wider portion 21 extending along the other two thirds of the length of the roller 3.

In operation the rollers 2 and 3 rotate with a peripheral speed substantially equal to the speed of the web 4 and the blade member 1 may carry out four different operations in accordance with the position of the roller 3 and thereby the recesses 19, 20 and 21 relative to the blade member 1 in the active position of said blade member in contact with the web.

In the case the roller 3 is in a position to be contacted by the blade member 1 along dotted line 22, a perforation 25 will be carried out in the web 4 as the blade member 1 will only perforate the web 4 along the line 22 and not along the recess 19 where the web 4 only will be deflected by the blade member 4. Correspondingly, the perforations 26 will be performed in case the blade member 1 contacts the roller 3 along the dotted line 23, and the perforations 27 will be performed in case the blade member 1 contacts the roller 3 along the dotted line 24 and finally, no perforation will be performed in case the blade member 1 is opposite the recess 20.

In this embodiment sheets of different width may for instance be printed and selectively perforated on the web 4 or two parallel webs with different widths arranged alongside each other.

The embodiments illustrated in Figs. 8-11 demonstrate the many possibilities of varying the patterns of the counter pressure means to obtain varying perforation configurations on a continuous web.

In Fig. 11 there is furthermore illustrated the possibility of arranging one or more extra counter pressure patterns on the counter pressure roller 3. A further recess 28 is provided in the surface of the roller 3 constituting part of another counter pressure means pattern angularly displaced on the surface of the roller relative to the one just described. This second pattern may be brought into operation instead of the first described pattern by either manually pivoting the roller 3 to bring the second pattern into synchronization with the blade member 1 or by doing so mechanically during operation of the device in which case the processing speed of the web will have to be reduced substantially during the change over process to give sufficient time for the process.

Referring now to Figs 12-14 illustrating a sixth embodiment of the device according to the invention, the general arrangement is very similar to Figs. 8-11 except that the blade member 1 has a sharpened, smooth edge and the counter pressure means are arranged in a rod 29 replaceably embedded in and protruding from the surface of the roller 3, the rod being provided with a row of recesses or indentations 30.

In operation, the roller 3 is retarded or advanced in its rotation so that the blade member 1 may contact the rod 29 either along the dotted line 31 or the dotted line 32. Contact along the dotted line 31 will entail that the web 4 is cut or severed along lines 33 and contact along the dotted line 32 will entail that the web 4 is perforated along a line

34 as the regions of the web along dotted line 32 will be cut or perforated while the regions of the web overlying the recesses 30 along dotted line 32 will only be deflected and not cut or perforated. If not cutting or perforation is desired, the roller 3 is advanced or retarded in its rotation so that the blade member 1 does not contact the rod 29 at all.

Hereby it is achieved that the web may be cut into lengths consisting of a multiple of a standard sheet length or width and that perforation lines 34 allowing folding of the severed lengths may be interspersed between the cut or severing lines 33.

Naturally the counter pressure pattern illustrated in Figs. 13 and 14 may be supplemented with an uninterrupted recess extending along the entire length of the rod, said recess being used for avoiding both a cut line and a perforation line if that should be desirable.

The recesses 30 may furthermore be modified so as to be tapered in the circumferential direction of the surface of the roller 3 so that the length of the individual perforations or cuts in a perforation line may be varied by displacing the roller 3 for selectively achieving contact between the blade member 1 with two different dotted lines instead of one dotted line 32 along the recesses 30. Hereby it is achieved that the two different perforation lines obtained hereby in the web have different tearing strengths which is desirable in certain applications where mechanic tearing is to be applied to some, weaker, perforation lines in the web 4 at a later stage in the processing of same while leaving the other, stronger, perforation lines intact for manual tearing by, for instance, the end user.

Referring now to Fig. 15 diagrammatically illustrating a seventh and currently most preferred embodiment of the device according to the invention, a perforating blade member 1 is

removably attached inside a channel 34 of a circular cylindrical roller 2 arranged for rotation about an axis 2a, the blade member 1 being attached by means of bolts 35 and a pressure rod 36 pressing the blade member 1 firmly into place in the channel 34. A cutting blade member 37 is removably attached inside a channel 38 of the roller 2 by means of bolts 39 and a pressure rod 40 and an intermediary strip 41 pressing the blade member 37 firmly into place in the channel 38. The axis 2a extends substantially at right angles to the direction of movement of a not shown continuous web of paper being moved through the device in the same manner as shown and described in the previously described embodiments.

A second circular cylindrical roller 3 is arranged for rotation about an axis 3a arranged with a skewed inclination relative to the axis 2a. A rod 42 is removably embedded in the roller 3, the surface of the rod 42 protruding beyond the surface of said roller 3. The surface of the rod 42 has a hyperboloidical shape and is provided with recesses 43 and 44 corresponding to the recesses 19 and 20 shown in Fig. 9 but having a curved shape along the length thereof.

A second rod 45 is removably embedded in the roller 3 at an angular distance along the circumference of the roller 3 from the rod 42 corresponding to the angular distance along the circumference of the roller 2 from the blade member 1 to the blade member 37.

The roller 2 is provided with a rotation gear 46 in engagement with a gear 47 in turn in engagement with a gear 48 in turn in engagement with a driven gear 49 thereby constituting a gear train between the driven gear 49 and the rotation gear 46.

The driven gear 49 is in engagement with a displaceable gear 50 in turn in engagement with a rotation gear 51 provided on the roller 3 thereby providing a gear train between the driven gear 49 and the rotation gear 51.

The speed of the driven gear and thereby the speed of the rollers 2 and 3 is controlled by not shown controlling means receiving signals from a not shown sensing means for sensing the variable speed of the web, such as sensing means to sense the tension of a depending loop of the web prior to or after passage through the device, the said controlling means adjusting the speed of the driven gear 49 according to signals transmitted thereto from the sensing means.

The displaceable gear 50 is mounted on a piston rod 52 of a double action piston and cylinder device 53 having four different positions of the piston rod 52.

In operation, the driven gear 49 rotates the rollers 2 and 3 in synchronization with one another and with the speed of travel of the web such that the blade member 1 is opposite the rod 36 at the same time as the blade member 37 is opposite the rod 45 for each revolution of the rollers thereby selectively perforating the web and cutting it in a manner very similar to the manner described in relation to the previously described embodiments. A perforation may for instance be performed by blade member 37 and rod 45 for each of four selective perforation types performable by blade member 1 and rod 36.

The selection of the various possible relative positions of the blade member 1 and the rod 37 is controlled either by not shown sensing means for sensing a mark such as a bar code printed or otherwise provided on the web, said sensing means transmitting a signal to not shown controlling means for controlling the operation of the piston and cylinder device 53. Alternatively, the operation of the piston device 53 is controlled by a signal from a not shown associated printing device or some other controlling device such as a computer.

The retardation or advancement of the rotation of the roller 3 is achieved by displacing the roller 50 by means of the piston device 53 in the direction of the two arrows, the

stroke lengths of said piston device corresponding to the desired retardation or advancement of the rotation of the roller 3.

The distance between the perforation lines and the cut lines in the web may be varied by moving the intermediary strip 41 to the other side of the blade member 37, i.e. so that the blade member is between the pressure rod 40 and the strip 41, and tightening the bolts 39 correspondingly.

The skewed inclination of the axis 3a relative to the axis 2a together with the hyperboloidical shape of the surface of the rod 42 as well as the curved lengthwise shape of the recesses 43 and 44 entail that the perforation and cutting operations of the blade members 1 and 37 against the rods 42 and 45 will take place progressively along the width of the web thereby reducing the impact forces and the resulting noise level.

Referring now to Figs. 16-18 schematically illustrating embodiments of the device according to the invention for achieving the reduced impact forces and noise level by performing the perforation, cutting or scoring operations progressively across the width of the web are shown.

In Fig. 16 both the rollers 2 and 3 have a skewed inclination in relation to each other and the perpendicular to the direction of movement of the web, both rollers being designed with hyperboloidical surfaces corresponding to the desired degree of progressivity of the operations.

In Fig. 17 there is shown the arrangement of the blade member 1 and recesses 19-21 in the surface of the roller 3 illustrating the skewed arrangement and curved shape of both the blade member and the recesses corresponding to the skewed arrangement and hyperboloidical shape of the two rollers 2 and 3 in Fig. 16.

In Fig. 18 the roller 2 is circular cylindrical with the axis 2a generally at right angles to the direction of movement of the web, and the roller 3 is hyperboloidical and skewed relative to the roller 2. This entails that the blade member 1 may be a standard rectilinear blade member while the recesses 19-21 are skewed and curved corresponding to this arrangement and shape of the two rollers 2 and 3 and the desired degree of progressivity of the perforation operations.

Referring now to Figs. 19-21, a web 4 moves in the direction of the arrow R4 between two rollers 2 and 3 rotating in the direction of the arrows R5 and R6, respectively. A rotative perforating knife 55 is fixedly arranged on the roller 2 for rotation around the axis of rotation 2a of same. A rotative, generally circular disc 56 is arranged for rotation on the roller 3 around the axis of rotation 3a of same. The disc 56 may be axially displaced to and fro on the roller 3 in the direction of the arrows R7 by means of axial displacement means (not shown) arranged in the roller 3 and connected to the disc 58 through slits (not shown) in the surface of the roller 3. The axial displacement means may comprise a hydraulic piston and cylinder device or any other means for achieving the axial displacement of the disc 56.

The periphery of the disc 56 has three circumferential regions 57, 58 and 59 having different diameters with respect to the axis 3a. The region 57 has a region 57a with full diameter and a region 57b with reduced diameter, while the region 59 has a region 59a with full diameter and a region 59b with reduced diameter. The regions 57a and 59a are circumferentially staggered with respect to one another.

In operation the disc 56 is in the position shown in Fig. 20 relative to the knife 55 or in a position opposite the region 58 when a longitudinal perforation is not to be performed. If a short longitudinal perforation having a first location relative to direction of movement of the web is to be per-

formed the disc 56 is displaced axially until the region 59 is opposite the knife 55, said displacement taking place while the region 59b circumferentially coincides with the knife 55. As the roller 3 rotates, the full diameter region 59a will contact the edge of the knife 55 with the web 4 therebetween, thereby performing a longitudinal perforation having a length corresponding to the circumferential length of the region 59a. If it thereafter is desired to perform a perforation having a second location relative to the direction of movement of the web and perhaps a different length than the one corresponding to region 59, the disc 56 is axially displaced such that the region 57 is opposite the knife 55 whereafter the perforation will be carried out through cooperation between the edge of the knife 55 and the surface of the region 57a.

Although several embodiments of the method and the device according to the invention have been described in the foregoing, they are only to be considered as examples and many variations and modifications are conceivable for those skilled in the art within the scope of the appended claims.

Thus the active means for perforating, cutting or scoring and the corresponding recesses or ridges or other configurations of the pattern of the counter pressure means may be inclined with respect to the perpendicular to the direction of movement of the web, they may be of many different lengths and have variously curved, serrated and other shapes corresponding to various desired tear out shapes or configurations and cut out or cut away portions of the web to be provided selectively along the length thereof.

The length of the perforations, cuts or scores may be of any practicable size, for instance for perforating tear-out lines for a tear-out or tear-off coupon from the interior of the web or a peripheral portion of same, respectively.

The displacement means may comprise two or more displaceable gears to achieve further active positions, or they may comprise planetary gears, chain transmissions, toothed belt transmissions, electrical step motors, electronically controlled variable speed electric motors and so on.

The counter pressure means (for instance the pattern of recesses and intermediary, full diameter regions shown in Figs. 8-11) on a roller need not necessarily be displaced to and fro to utilize elements of the same pattern together with a blade member, but the patterns may repeat themselves regularly around the entire circumference of the roller, the displacement being in only one direction sequentially from pattern to pattern around the roller. Thus a different one of the identical patterns may be brought into cooperation with the blade member or blade members sequentially along the circumference of the roller, for instance the counter pressure roller 3 of Figs. 8-11) with such a repeated series of patterns.

In such case, where the patterns repeat themselves on the roller 3, the blade roller 2 may further be interchangeable with one or more rollers having different diameters corresponding to a different distance (or pitch) between the perforations along the direction of movement of the web 4. In case it for instance is desirable that this distance between the perforations may be varied from 12 inches (corresponding to the length of e.g. a bill sheet of 12 inches) to a smaller length of 11 inches (corresponding to a sheet length of 11 inches), 12 patterns on the roller 3 having a circumference of 12 inches are regularly distributed around said circumference with a pitch of 1 inch. When the distance between the perforations is to be 12 inches, a roller 2 having a circumference of 12 inches is employed, the blade member or members cooperating with the same patterns in case the roller 3 is not advanced sequentially to bring a new pattern into play, or with a subsequent pattern in case the roller 3 is advanced sequentially as described in the preceding paragraph. When it

is desired to change over to a sheet length of 11 inches, the 12-inch roller 2 is replaced by a roller 2 having a circumference of 11 inches, and the blade member or members will sequentially cooperate with a new pattern in both cases (i.e. whether the roller 3 is advanced sequentially or not).

It will be obvious to those skilled in the art that, in the embodiments described in the preceding paragraphs, by varying the diameter of either or both the rollers 2 and 3 and/or by selecting the number of patterns on the roller 3 and the number of blades on the roller 2, the pitch of the perforations on the web may be varied as desired within the limits imposed by practical considerations. These variations will require modifications and changes in the driving mechanisms for the rollers 2 and 3 as well as the suspension arrangements for same and finally in the displacement means. Such changes and modifications will be apparent to those skilled in the art.

The counter pressure means may, in further embodiments of the invention, be mounted on a body being displaced to and fro into the active position relative to the active means, for instance on pivotable arms or on slidable means being moved to and fro such that the direction and speed of movement of the counter pressure means is substantially equal to the direction and speed of travel of the web in the active position.

Although for some applications it is advantageous that the speed of movement of the counter pressure means is comparable to or preferably equal to the speed of travel of the web in the active position, for other applications a substantial difference in said speeds is not important.

The web may be a composite comprising two or more layers or discrete, superimposed webs such as for instance for different copies of a printed sheet. In that case, one or more of the recesses 19, 20 and 21 in Fig. 9 may comprise regions

extending along at least part of the length of the recesses and having two different depths, so that for instance a perforation only will extend through some of the layers or discrete webs when the blade member 1 is opposite the deeper region of the respective recess, and will extend through all of the layers or discrete webs when the blade member is opposite the shallower region of the respective recess.

CLAIMS

1. A method for sequentially perforating and/or cutting and/or scoring a continuous web of material such as paper, cardboard or the like being moved lengthwise between active means for sequentially perforating and/or cutting and/or scoring the web and counter pressure means for pressing the web against the active means when the active means and the counter pressure means are in an active position relative to one another, said method being characterized in that the counter pressure means and/or that the active means are selectively moved into and out of a selectively active position in which they exert pressure against each other and against the portion of the web lying therebetween during the movement of the web.

2. A method according to claim 1, wherein the active means are moved substantially in the same direction and at a speed comparable to the speed of the web when the active means and the counter pressure means are in the selectively active position.

3. A method according to claim 1 or 2, wherein the counter pressure means are moved substantially in the same direction and at a speed comparable to the speed of the web when the active means and the counter pressure means are in the selectively active position.

4. A method according to any of preceding claims, wherein the active means and the counter pressure means are substantially linear and extend substantially at right angles to the direction of movement of the web.

5. A method according to any of the claims 1-4, wherein the movement of the active means comprises pivoting about an axis substantially at right angles to the direction of movement of the web.

6. A method according to any of the claims 1-5, wherein the movement of the counter pressure means comprises pivoting about an axis substantially at right angles to the direction of movement of the web.

7. A method according to any of the claims 1-6, wherein the active means are arranged on the outer surface of a first rotative body being rotated with a peripheral speed generally comparable with and preferably substantially equal to the speed of movement of the web.

8. A method according to any of the claims 1-7, wherein the counter pressure means are arranged on a surface portion arranged on a second rotative body being rotated with a peripheral speed generally comparable with and preferably substantially equal to the speed of movement of the web.

9. A method according to any of the claims 4-8, wherein the counter pressure means comprise one or more inactive regions with an increased distance from the active means in the selectively active position of same, the method comprising the step of selectively retarding or advancing the movement of the counter pressure means and/or the active means by an amount sufficient to locate an inactive region opposite the active means in the selectively active position of same, the inactive region having a width and depth sufficient to allow the web to be deflected into the inactive region by the active means.

10. A method according to claim 9, wherein the active means comprise at least one linear perforating, cutting or scoring means extending across the entire width of a longitudinal portion of the web and the counter pressure means comprise at least one inactive region extending across the entire width of the web portion, at least one inactive region extending across one part of the width of the web portion and at least one inactive region extending across another part of the width of the web portion, the method further comprising the

step of selectively retarding or advancing the movement of the counter pressure means and/or the active means by an amount sufficient to locate a selected inactive region opposite the perforating, cutting or scoring means or a selected one of same in the selectively active position of same.

11. A method according to claim 9 or 10, wherein the inactive region or regions are constituted by one or more substantially linear and substantially mutually parallel recesses or indentations in the surface portion.

12. A method according to any of the preceding claims, wherein the speed of movement of the active means and/or the counter pressure means is controlled according to a variable speed of movement of the web.

13. A method according to any of the claims 9-12, wherein the retardation and the advancement of the movement of the counter pressure means and/or the active means is controlled by signals such as from an associated printing device, some other controlling apparatus or controlling electronics, or from sensing means, said sensing means sensing the passage thereby of a particular mark such as a bar code on the web corresponding to a desired respective perforating, cutting or scoring operation on the web.

14. A method according to any of the claims 7-13, wherein the second rotative body has a skew inclination relative to the first rotative body and at least the region of the outer surface of the second rotative body encompassing the counter pressure means has a corresponding hyperboloidical shape for allowing the active means to contact the counter pressure means progressively along the length thereof during rotation of the first and second rotative body through the selectively active position thereof.

15. A device for sequentially perforating and/or cutting and/or scoring a web of material such as paper, cardboard or

the like arranged to move lengthwise through the apparatus, said device comprising active means for sequentially perforating and/or cutting and/or scoring the web and counter pressure means for pressing the web against the active means when the web is moved therebetween in an active position of the active means relative to the counter pressure means, characterized in that the device further comprises first and/or second displacement means for selectively displacing the active means and the counter pressure means, respectively, relative to one another into and out of a selectively active position in which they exert pressure against each other and against the portion of the web lying therebetween during the movement of the web.

16. A device according to claim 15, wherein the active means are arranged on a first surface portion arranged on a first rotative body arranged for rotation about a first axis, and the counter pressure means are arranged on a second surface portion arranged on a second rotative body arranged for rotation about a second axis, the arrangement and the spacing of the first and second axis relative to each other and relative to the web being such that the active means may selectively be brought into an active position relative to the counter pressure means and the web while moving in substantially the same direction and at substantially the same speed as the web, the counter pressure means comprising one or more inactive regions and active regions arranged at a smaller and a larger distance, respectively, from the second axis, the inactive region or regions having a width and depth sufficient to allow the web to be deflected into the inactive region by the active means.

17. A device according claim 16, wherein the first and/or second displacement means comprise means to selectively retard or advance the rotation of the second rotative body relative to the rotation of the first rotative body by an amount sufficient to selectively locate an inactive or an

active region opposite at least part of the active means in the active position of same.

18. A device according to claim 16 or 17, wherein the active means comprise a substantially rectilinear, perforating, cutting or scoring blade member arranged protruding from the surface of a first rotative body and extending substantially parallel to the axis of rotation of the first rotative body.

19. A device according to claim 18, wherein the counter pressure means comprise one or more substantially rectilinear recesses or indentations in the second surface portion arranged on the second rotative body, the recess or recesses extending substantially parallel to the axis of rotation of the second rotative body, the recesses constituting the inactive region or regions and at least part of the unrecessed or unindented portions of said second surface portion adjacent the recesses constituting the active region or regions.

20. A device according to any of the claims 16-19, wherein the first and/or the second rotative body is constituted by a substantially circular first and/or second cylindrical roller, respectively.

21. A device according to claim 19 or 20, wherein, in the said active position, at least one blade member extends across the entire width of a longitudinal web portion, at least one recess extends across one part of the width of the web portion and at least one recess extends across another part of the width of the web portion.

22. A device according to claim 21, wherein the parts of the width of the web portion across which the various recesses extend in said active position comprise the entire width of the web portion, one half of the width extending from a longitudinal edge of the web portion and the other half of

the width extending from the other longitudinal edge of the web portion.

23. A device according to any of the claims 18-22, wherein the counter pressure means comprise one or more substantially rectilinear raised portions or ridges in the second surface portion arranged on the second rotative body, the ridge or ridges extending substantially parallel to the axis of rotation of the second rotative body, the ridge or ridges constituting the active region or regions and at least part of the portions of said second surface portion adjacent the ridge or ridges constituting the inactive region or regions.

24. A device according to any of the claims 19-23, wherein said second surface portion is integral with the second rotative body.

25. A device according to any of the claims 19-23, wherein said second surface portion is part of a replaceable element attached to the second rotative body.

26. A device according to any of the claims 19-25, wherein at least the second surface portion and the underlying region thereof is made from a material highly resistant to wear caused by repeated contact with the blade member.

27. A device according to any of the claims 16-26, wherein the first and the second axes are skewed in relation to each other, the active means comprise a substantially linear, perforating, cutting or scoring blade member arranged protruding from the first surface portion, and the counter pressure means comprise one or more substantially linear recesses or indentations in the second surface portion, the recesses constituting the inactive region or regions, and at least part of the unrecessed or unindented portions of said second surface portion adjacent the recesses constituting the active region or regions; at least the region of the second surface region encompassing the counter pressure means having

a hyperboloidical shape corresponding to the skewed relationship of the first and the second axis such that the blade member contacts the counter pressure means progressively along the length thereof during rotation of the first and second rotative body through the selectively active position thereof, the blade member and/or the recess or recesses extending substantially rectilinearly and substantially perpendicularly to the direction of movement of the web with a skewed relationship to one another; and/or the blade member and/or the recesses having a curvature corresponding to said hyperboloidical shape and/or said skewed relationship between the first and the second axis and/or between the blade member and the recess or recesses.

28. A device according to any of the claims 16-27, wherein the said second displacement means comprise a displacement gear displaceable in its own plane in a direction substantially perpendicular to its axis of rotation and substantially perpendicular to the direction of the diameter of the displacement gear connecting the meshing regions of the displacement gear with two adjacent gears, the displacement gear forming part of a driving gear train connecting a driven gear and a rotation gear for rotating the second rotative body.

29. A device according to claim 28, wherein the driven gear is connected to a rotation gear for rotating the first rotative body by means of a transmission mechanism such as a gear train, a drive chain or a toothed belt.

30. A device according to claim 28 or 29, wherein the displacement gear is displaced by means of a piston and cylinder device, the piston having a number of different positions corresponding to the different positions of the counter pressure means relative to the active means in the active position of same.

31. A device according to any of the claims 15-30, wherein the device further comprises first controlling means for controlling the various operations of the device in dependency of a variable speed of movement of the web therethrough, first sensing means for sensing the variable speed, such as sensing means to sense the tension of a depending loop of the web prior to or after passage through the device, the first controlling means adjusting the speed and frequency of the various operations according to signals transmitted thereto, and first transmission means for transmitting signals from the first sensing means to the first controlling means.

32. A device according to any of the claims 15-31, wherein the device further comprises second sensing means for sensing marks such as bar codes on the web, second transmission means for transmitting signals from the second sensing means to second controlling means for controlling the operation of the first and/or second displacement means in accordance with a selected perforating, cutting or scoring operation indicated by the respective mark on the web being sensed.

33. A device according to any of the claims 15-31, wherein the device further comprises signal receiving means for receiving a signal such as from an associated printer, second controlling means for controlling the operation of the first and/or second displacement means in accordance with a selected perforating, cutting or scoring operation indicated by the respective signal being received.

34. A device according to any of the claims 20-33, wherein the first roller is arranged interchangeable with one or more rollers having a different diameter and/or a different number of active means, and the second roller is provided with a series of identical sets of counter pressure means arranged equidistantly around the circumference of the second roller.

35. A device according to claim 34, wherein the device further comprises means to advance or retard the second roller such that different sets of counter pressure means are sequentially brought into the active position relative to an active means of the first roller.

36. Active means having the features defined in any of the claims 15-35.

37. Counter pressure means having the features defined in any of the preceding claims 15-35.

38. A rotative body having the features defined in any of the preceding claims 16-35.

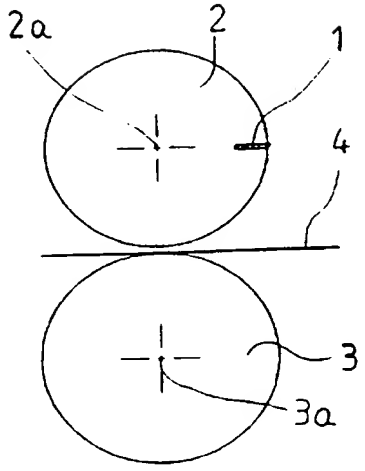


Fig. 1

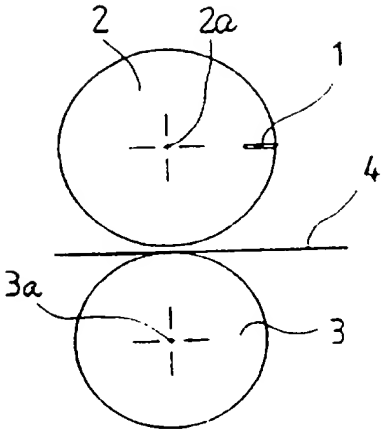


Fig. 2

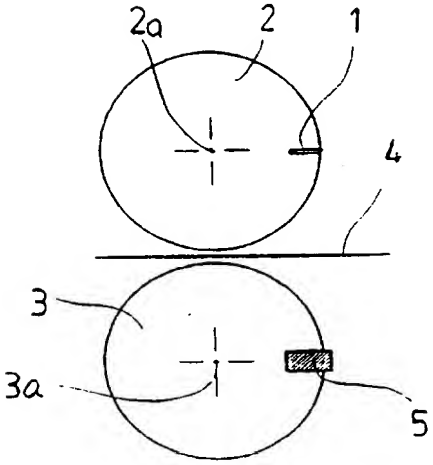


Fig. 3

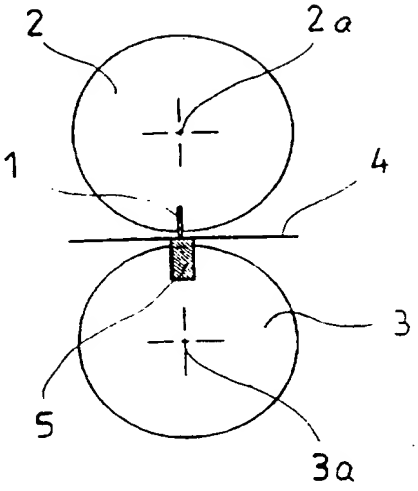


Fig. 4

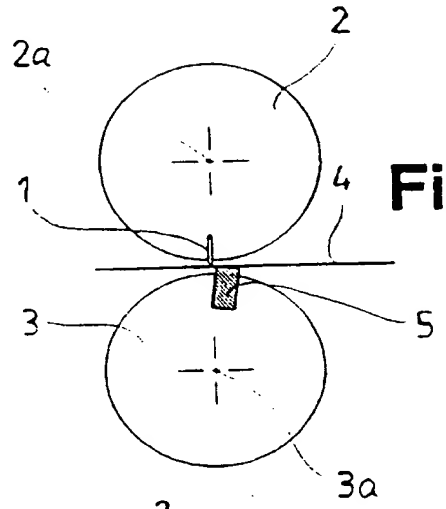


Fig. 5

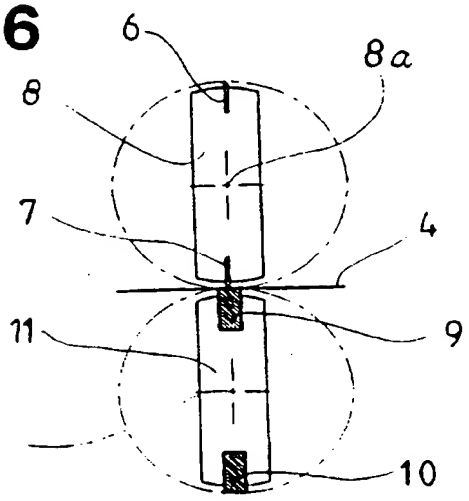


Fig. 6

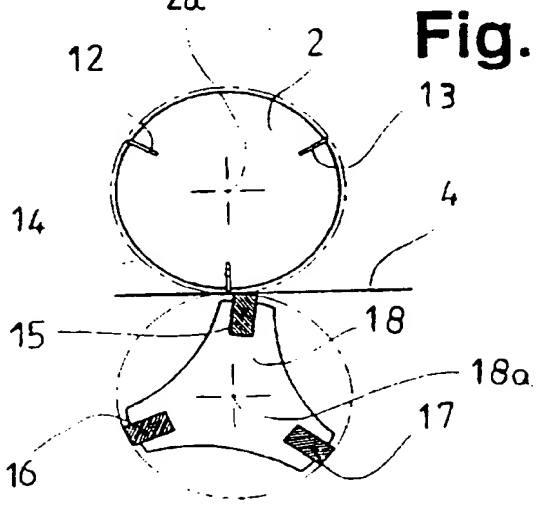


Fig. 7

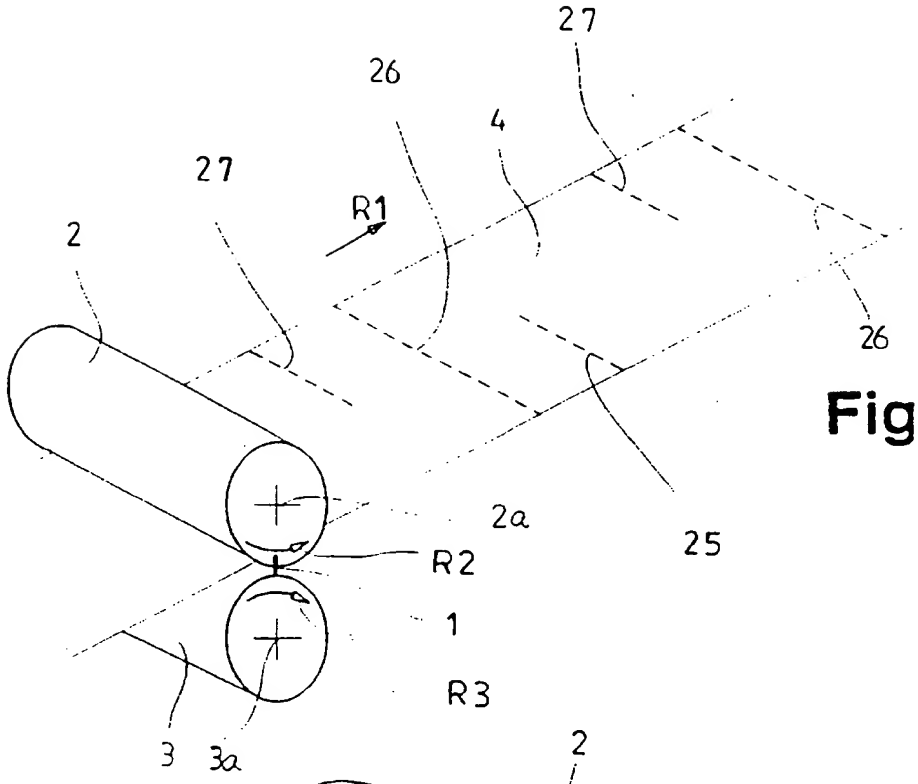


Fig. 8

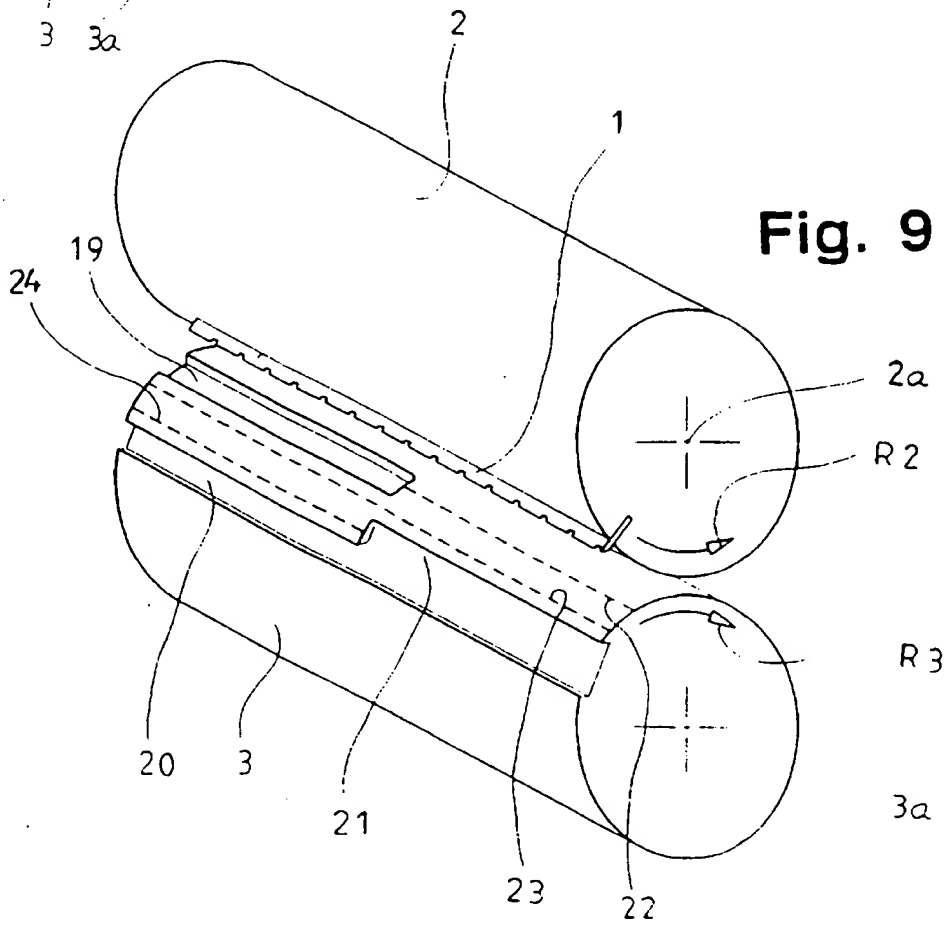


Fig. 9

Fig. 10

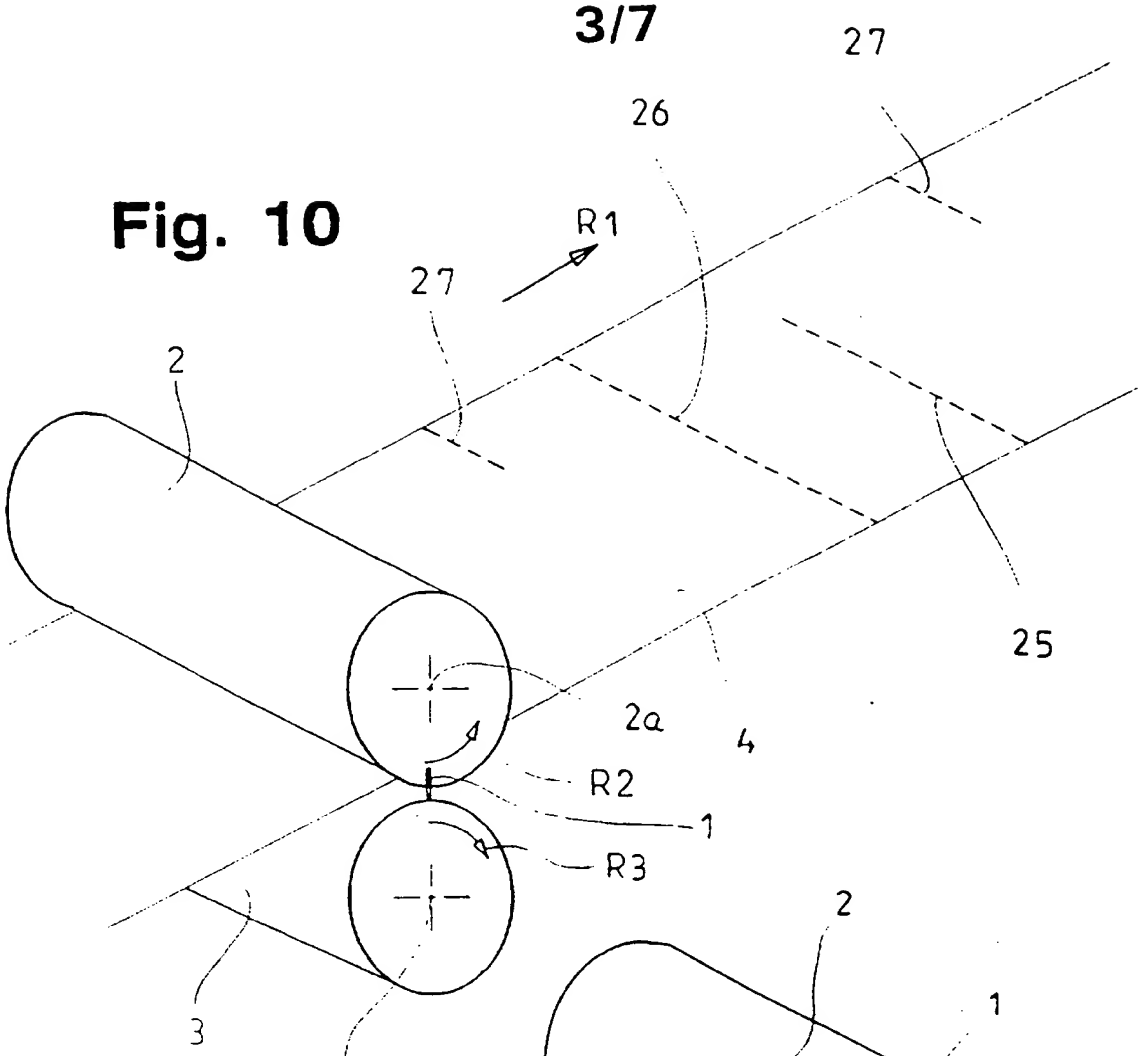
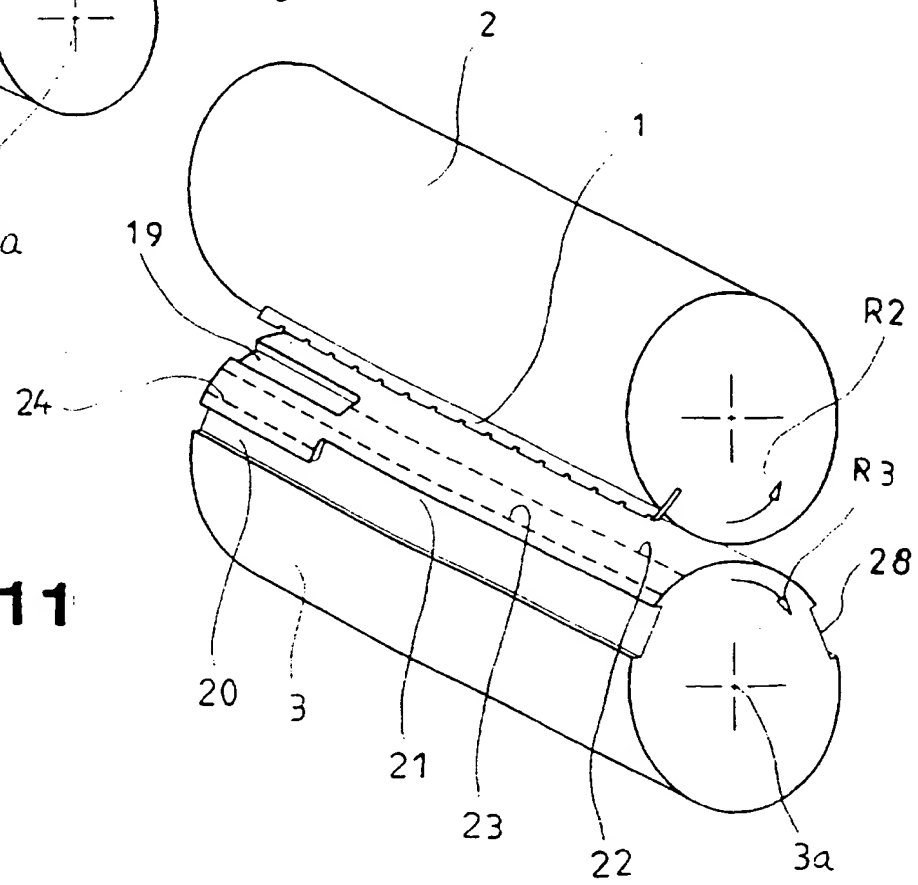


Fig. 11



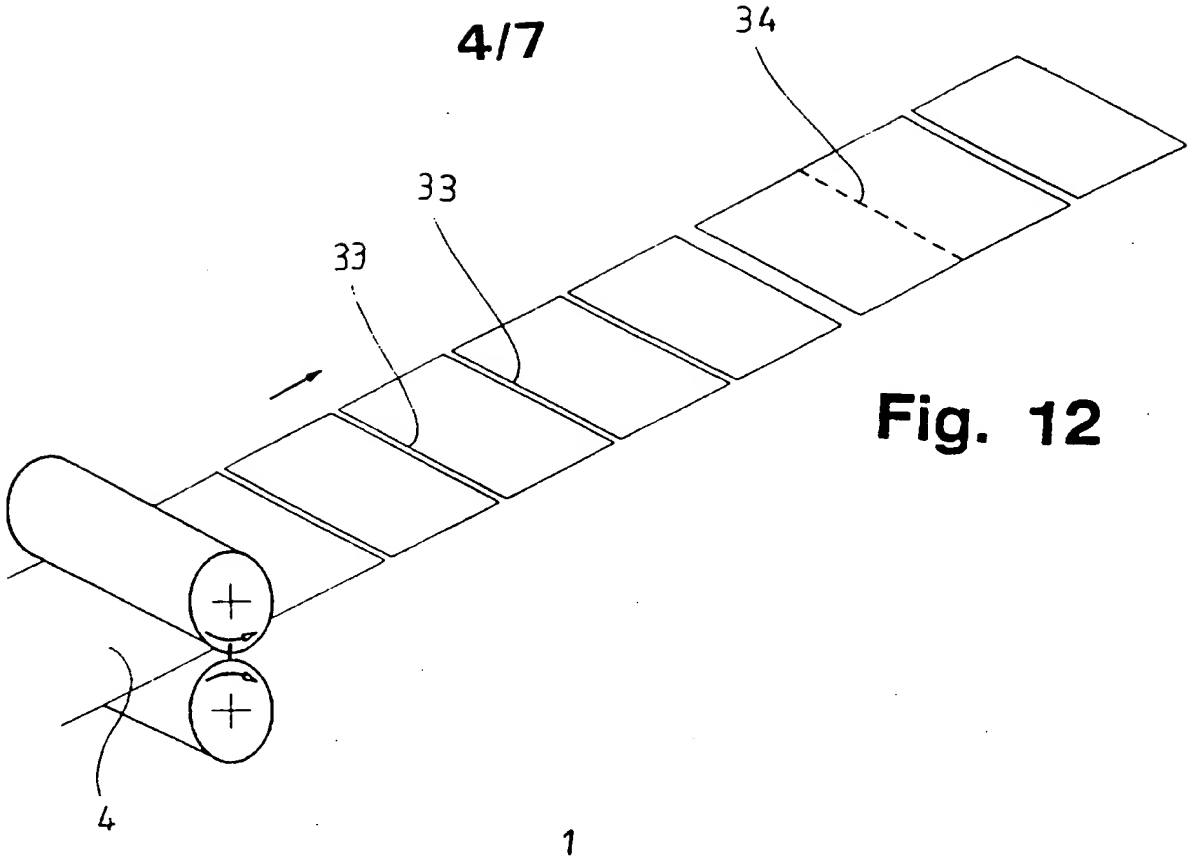


Fig. 12

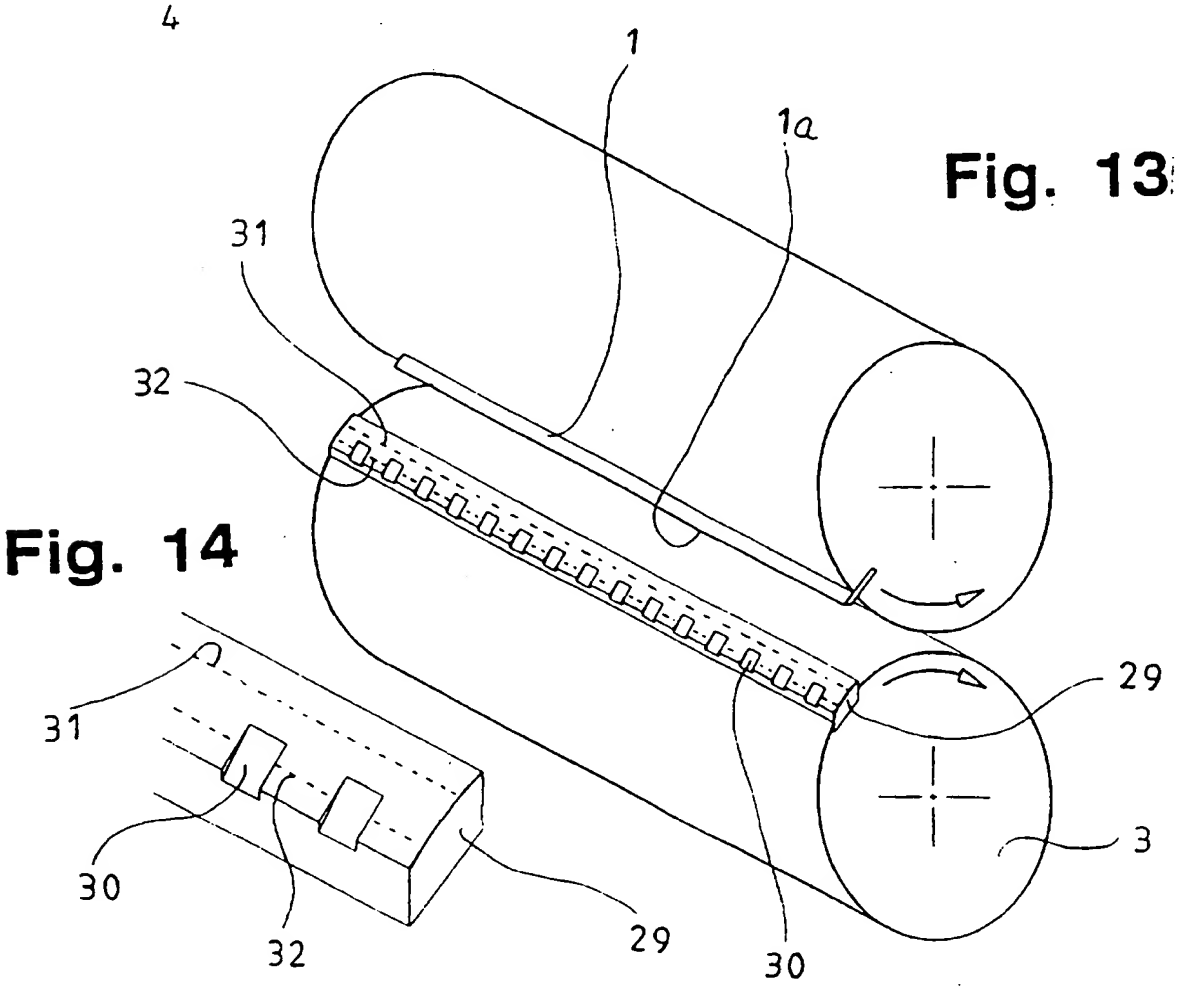


Fig. 13

Fig. 14

Fig. 15

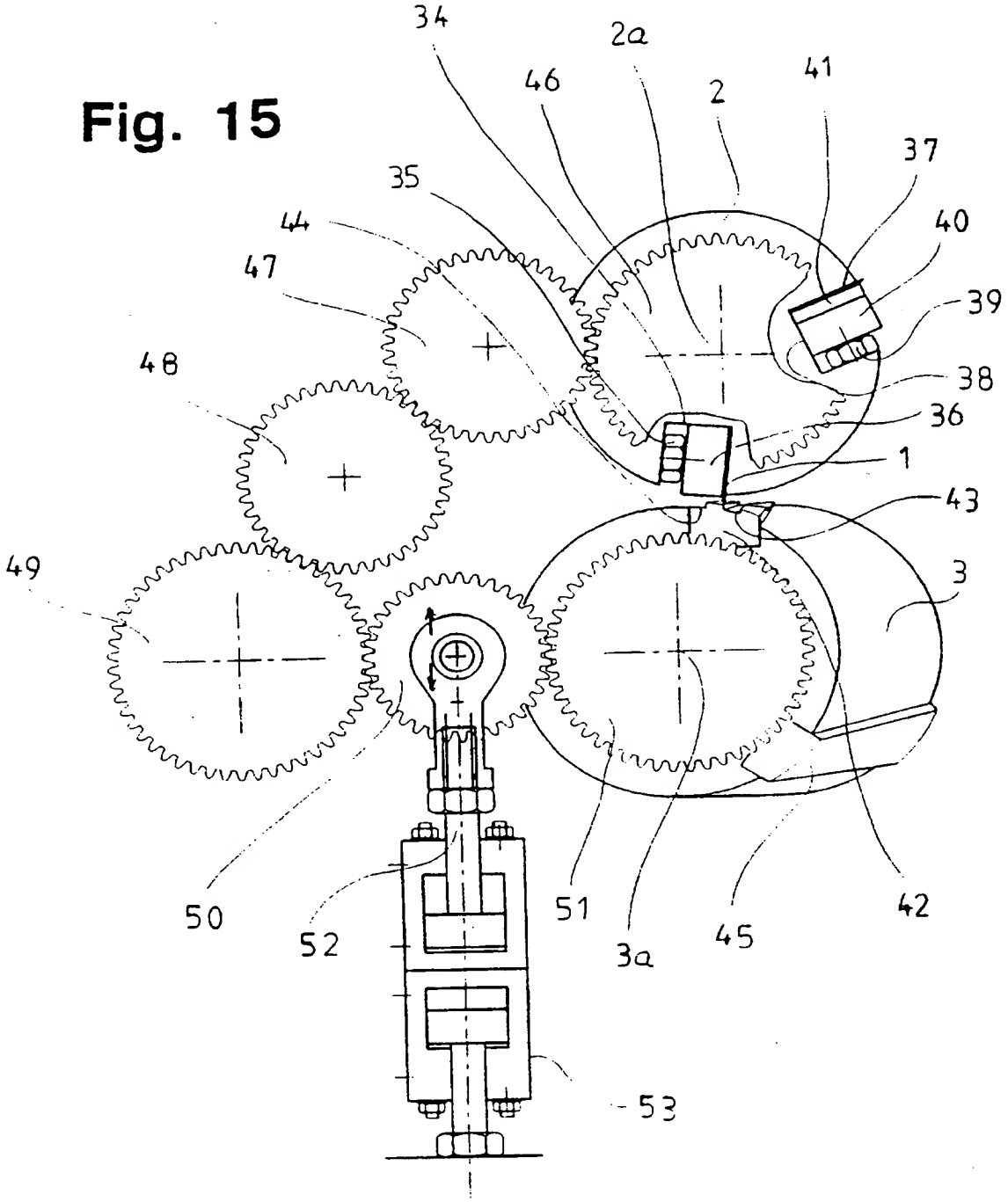


Fig. 16

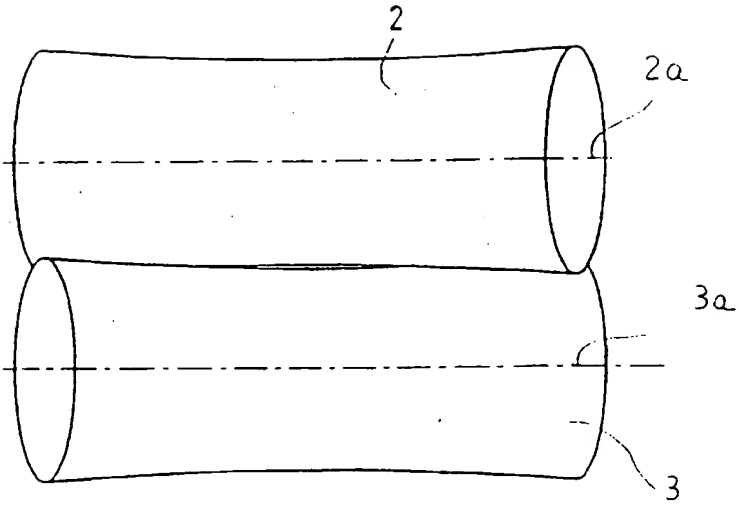


Fig. 17

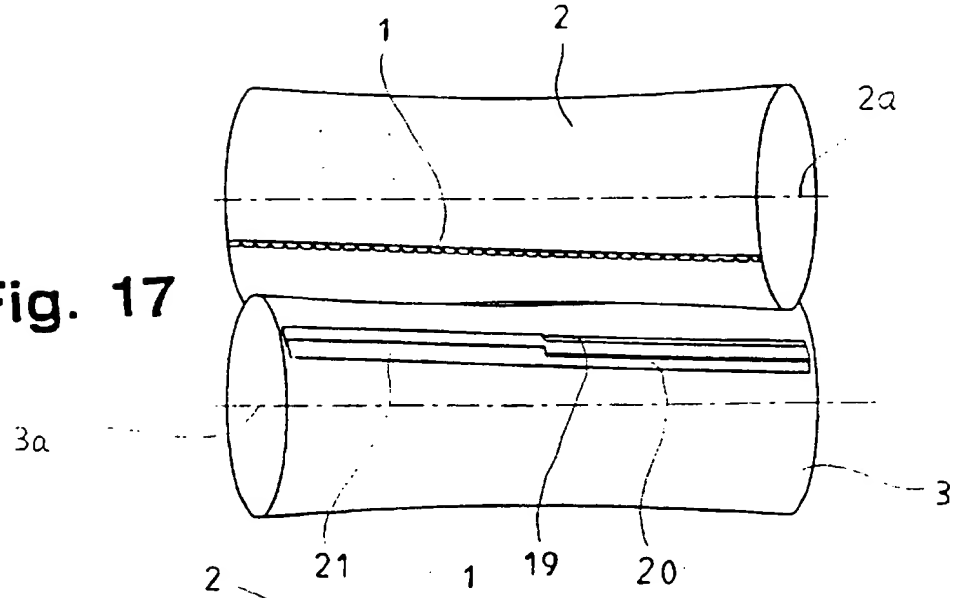


Fig. 18

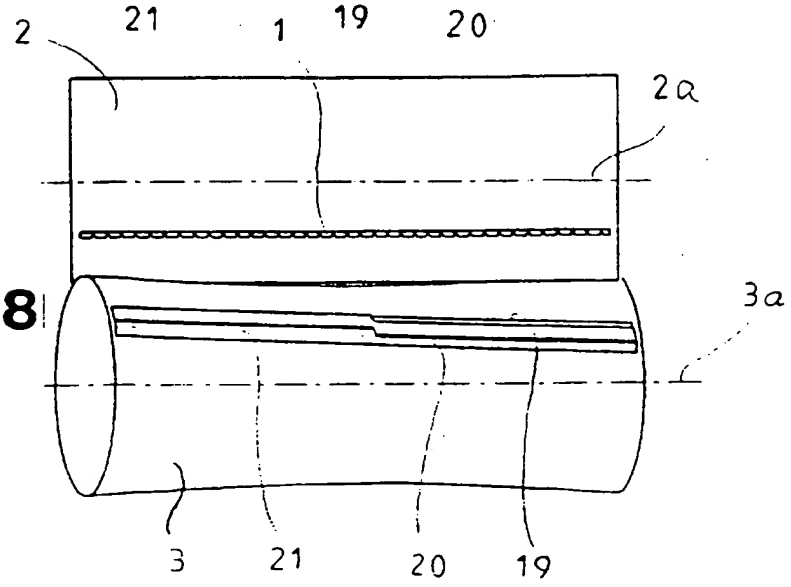


Fig. 19

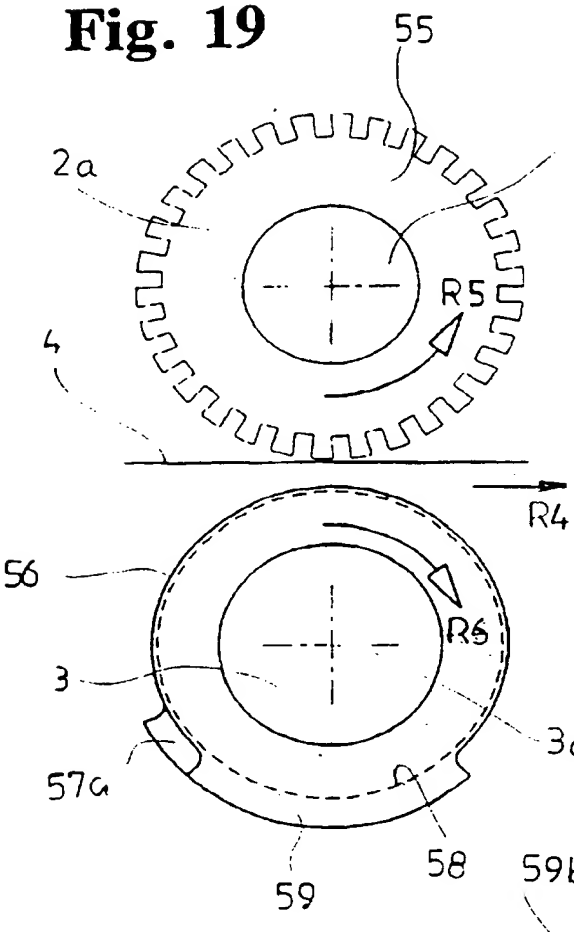
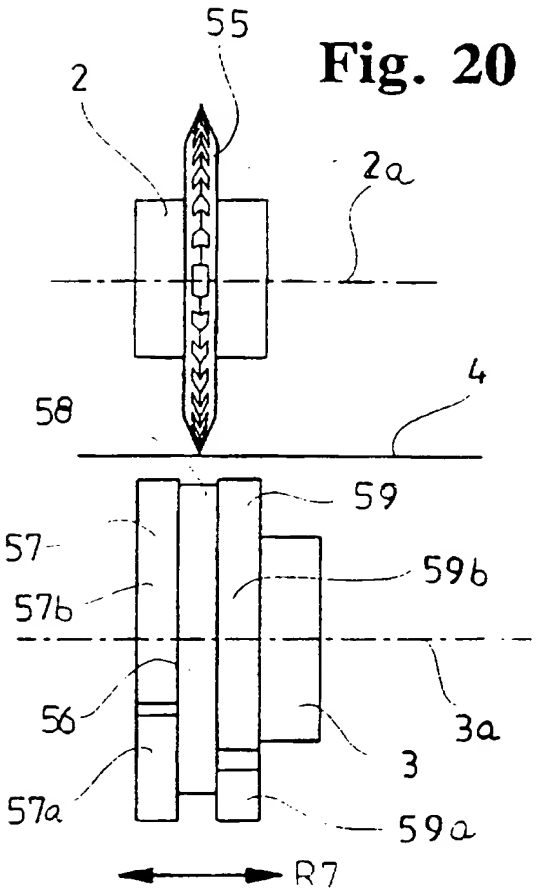


Fig. 20



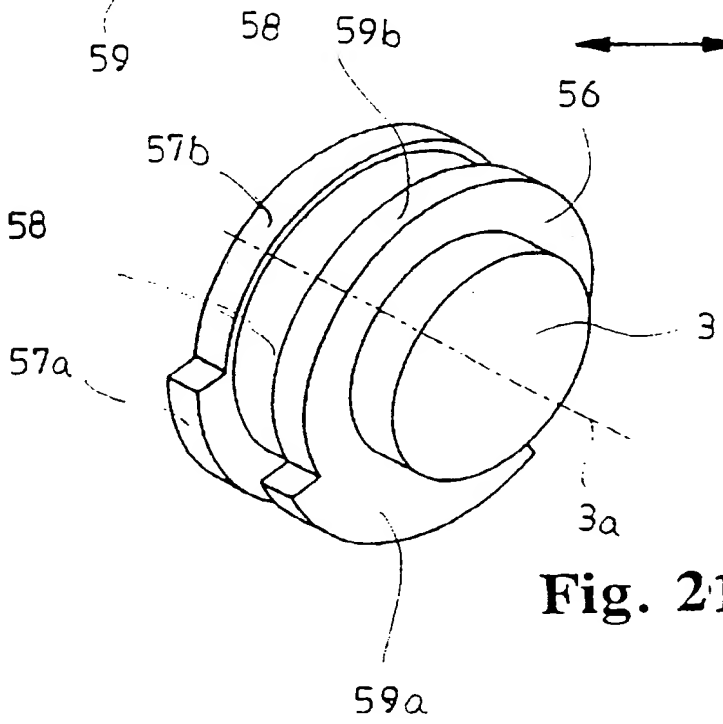


Fig. 21

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/DK 96/00532

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65H35/08 B26D1/62 B26D3/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B26D B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 534 177 A (MITSUBISHI JUKOGYO KABUSHIKI KAISHA) 31 March 1993	1-12, 15-26, 31,33, 36-38
Y	see column 1, line 13 - column 3, line 5; figures	13,14, 27,32

X	EP 0 683 020 A (BIELOMATIK LEUZE GMBH + CO.) 22 November 1995	1-9,11, 12, 15-20, 23,24, 31,33-38
	see column 4, line 22 - column 6, line 32 see column 7, line 45 - column 8, line 47 see column 9, line 38 - column 11, line 25; figures	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
1 April 1997	23. 05. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	David, P

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/UK 96/00532

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	see page 5, line 14 - page 6, line 10; figures 1,2	1,15

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